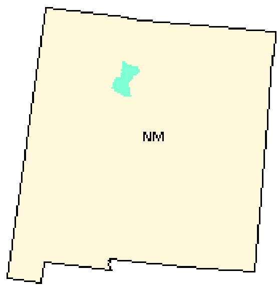
REVISED JUNE 2004

TOTAL MAXIMUM DAILY LOAD FOR TURBIDITY AND STREAM BOTTOM DEPOSITS for the Jemez River and the Rio Guadalupe



Summary Table

New Mexico Standards Segment	Rio Grande 20.6.4.107 and 20.6.4.108
Waterbody Identifier	Jemez River (Rio Guadalupe to HWY 4 nr Jemez Springs) MRG2-20000, NM-2105.5_10, 6.7 miles Rio Guadalupe (Jemez River to Rio Cebolla) MRG2-20100, NM-2106.A_30 (confluence to Gillman Tunnels 2.4 mi.)
Parameters of Concern	Stream Bottom Deposits and Turbidity
Uses Affected	Jemez River – Coldwater Fishery Rio Guadalupe – High Quality Coldwater Fishery
Geographic Location	Rio Grande Basin (Jemez)
Scope/size of Watershed	45 mi^2 Jemez 52 mi^2 Guadalupe
Land Type	Ecoregions: Southern Rockies (210, 211) Arizona-New Mexico Plateau (220, 221)
Land Use/Cover	Jemez: Forest (99%), Agriculture (<1%), Urban/Water (<1%) Guadalupe: Forest (99%), Agriculture (1%), Urban/Water (<1%)
Identified Sources	Agriculture, Road Maintenance/Runoff, Recreation, Removal of Riparian Vegetation, Streambank Modification/Destabilization, Natural, Municipal Point Source
Watershed Ownership	Jemez: Forest Service (76%), Private (24%) Guadalupe: Forest Service (93%), Tribal (4%), Private (3%)
Priority Ranking	Jemez River 2 and Rio Guadalupe 4
Threatened and Endangered Species	None
TMDL for: Turbidity (as TSS) Jemez River Rio Guadalupe Stream Bottom Deposits Jemez River Rio Guadalupe	 WLA(28.2) + LA(15650.8) + MOS5226)= **20905 lbs/day** WLA(0) + LA(22833) + MOS(7611)= **30444 lbs/day** WLA(0) + LA (15) + MOS(5)= **20% fines** WLA(0) + LA (15) + MOS(5)= **20% fines**

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to develop TMDL management plans for water bodies determined to be water quality limited. A TMDL documents the amount of a pollutant a water body can assimilate without violating a state's water quality standards. It also allocates that load capacity to known point sources and nonpoint sources at a given flow. TMDLs are defined in 40 CFR Part 130 as the sum of the individual Waste Load Allocations (WLA) for point sources and Load Allocations (LA) for nonpoint sources, including a margin of safety and natural background conditions.

The Jemez River Basin is a sub-basin of the Rio Grande Basin, located in northcentral New Mexico. Stations were located throughout the basin to evaluate the impact of tributary streams. As a result of this monitoring effort, several exceedances of New Mexico water quality standards for turbidity and stream bottom deposits (SBD) were documented on both the Jemez River (Rio Guadalupe to HWY 4 nr Jemez Springs) and the Rio Guadalupe (from the mouth on the Jemez River to the Gillman Tunnels). Stream bottom deposits were assessed using techniques in the SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a). Some level of impairment due to embeddedness was seen on both reaches. This Total Maximum Daily Load (TMDL) document addresses these two constituents.

A general implementation plan for activities to be established in the watershed is included in this document. The Surface Water Quality Bureau's Watershed Protection Section will further develop the details of this plan. Implementation of recommendations in this document will be done with full participation of all interested and affected parties. During implementation, additional water quality data will be generated. As a result, targets will be re-examined and potentially revised; this document is considered to be an evolving management plan. In the event that new data indicate that the targets used in this analysis are not appropriate or if new standards are adopted, the load capacity will be adjusted accordingly. When water quality standards have been achieved, the reach will be removed from the TMDL list.

NOTE: This TMDL was originally approved by the USEPA in December 1999. The TMDL was revised in 2004 to include a waste load allocation for the Village of Jemez Springs Municipal Wastewater Treatment Plant (WWTP).

List of Abbreviations

BMP	**Best Management Practice**
CFS	**Cubic Feet per Second**
CWA	**Clean Water Act**
CWAP	**Clean Water Action Plan**
CWF	**Coldwater Fishery**
EPA	**Environmental Protection Agency**
FS	**United States Department of Agriculture Forest Service**
HQCWF	**High Quality Coldwater Fishery**
ISI	**Interstitial Space Index**
LA	**Load Allocation**
MGD	**Million Gallons per Day**
mg/L	**Milligrams per Liter**
MOS	**Margin of Safety**
MOU	**Memorandum of Understanding**
NMED	**New Mexico Environment Department**
NMSHD	**New Mexico State Highway and Transportation Department**
NPDES	**National Pollutant Discharge Elimination System**
NPS	**Nonpoint Source**
NTU	**Nephelometric Turbidity Units**
SBD	**Stream Bottom Deposits**
SWQB	**Surface Water Quality Bureau**
TMDL	**Total Maximum Daily Load**
TSS	**Total Suspended Solids**
UWA	**Unified Watershed Assessment**
WLA	**Waste Load Allocation**
WQLS	**Water Quality Limited Segment**
WQCC	**New Mexico Water Quality Control Commission**
WQS	**Water Quality Standards (20 NMAC 6.1)**

Background Information

The Jemez River Basin is a sub-basin of the Rio Grande Basin, located in northcentral New Mexico. This 1043 mi^2 watershed is dominated by both forest and rangeland (Figure 1.A) on mostly Forest Service, Tribal, and private land. The Jemez River from Rio Guadalupe to the confluence of the East Fork of the Jemez River and San Antonio Creek is a 45 mi^2 watershed. The Rio Guadalupe from the mouth on the Jemez River to the confluence of the Rio de las Vacas and Rio Cebolla is a 52 mi^2 watershed. Both watersheds are located primarily on Forest Service Land.

Surface water quality monitoring stations were used to characterize the water quality of the stream reaches (Figure 1.B and 1.C). Stations were located to evaluate the impact of tributary streams and to establish background conditions. As a result of this monitoring effort, several exceedances of New Mexico water quality standards for turbidity and stream bottom deposits were documented on both the Jemez River from Rio Guadalupe to the confluence of the East Fork of the Jemez River and San Antonio Creek and the Rio Guadalupe from the mouth on the Jemez River to the confluence of the Rio de las Vacas and Rio Cebolla. Stream bottom deposits were assessed using techniques in the SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a). Some level of impairment due to embeddedness was seen on these reaches.

Endpoint Identification

Target Loading Capacity

Target values for turbidity and stream bottom deposits will be determined based on 1) the presence of numeric criteria, 2) the degree of experience in applying the indicator and 3) the ability to easily monitor and produce quantifiable and reproducible results.

The Jemez River from its confluence with the Rio Guadalupe upstream to State Highway 4 near the town of Jemez Springs and perennial reaches of Vallecitos Creek make up waterbody segment 20.6.4.107 The designated uses for this reach are: coldwater fishery, primary contact, livestock watering, and wildlife habitat. The standards are as follows:

1. In any single sample: temperature shall not exceed 25 C (77F), pH shall be within the range of 6.6 to 8.8, and turbidity shall not exceed 25 NTU. The use-specific numeric standards set forth in Section 3101 are applicable to the designated uses listed above in Section 2105.5.A.
2. The monthly geometric mean of fecal coliform bacteria shall not exceed 200/100 ml; no single sample shall exceed 400/100 ml (see Section 1103.B) (NMWQCC 1995).

The Jemez River and all its tributaries above State Highway 4 near the town of Jemez Springs and the Guadalupe River and all its tributaries make up waterbody segment 20.6.4.108. The


Figure 1.A
Jemez Basin
Landuse/Landcover
Rio De Las Vacas
Clear Creek
American Creek
Calaveras Creek
Rio Penas Negras
San Antonio Creek
Rio Cebolla
Sulphur Creek
Redondo Creek
East Fork of Jemez River
Jemez River
Rio Guadalupe
Vallecito Creek
Stream
Watershed Boundaries
Landuse Types
Urban (0.38%)
Agriculture (0.28%)
Range (5.58%)
Forest (93.54%)
Barren (0.17%)
Forest Landuse
2 0 2 4 Miles
N
W
E
S

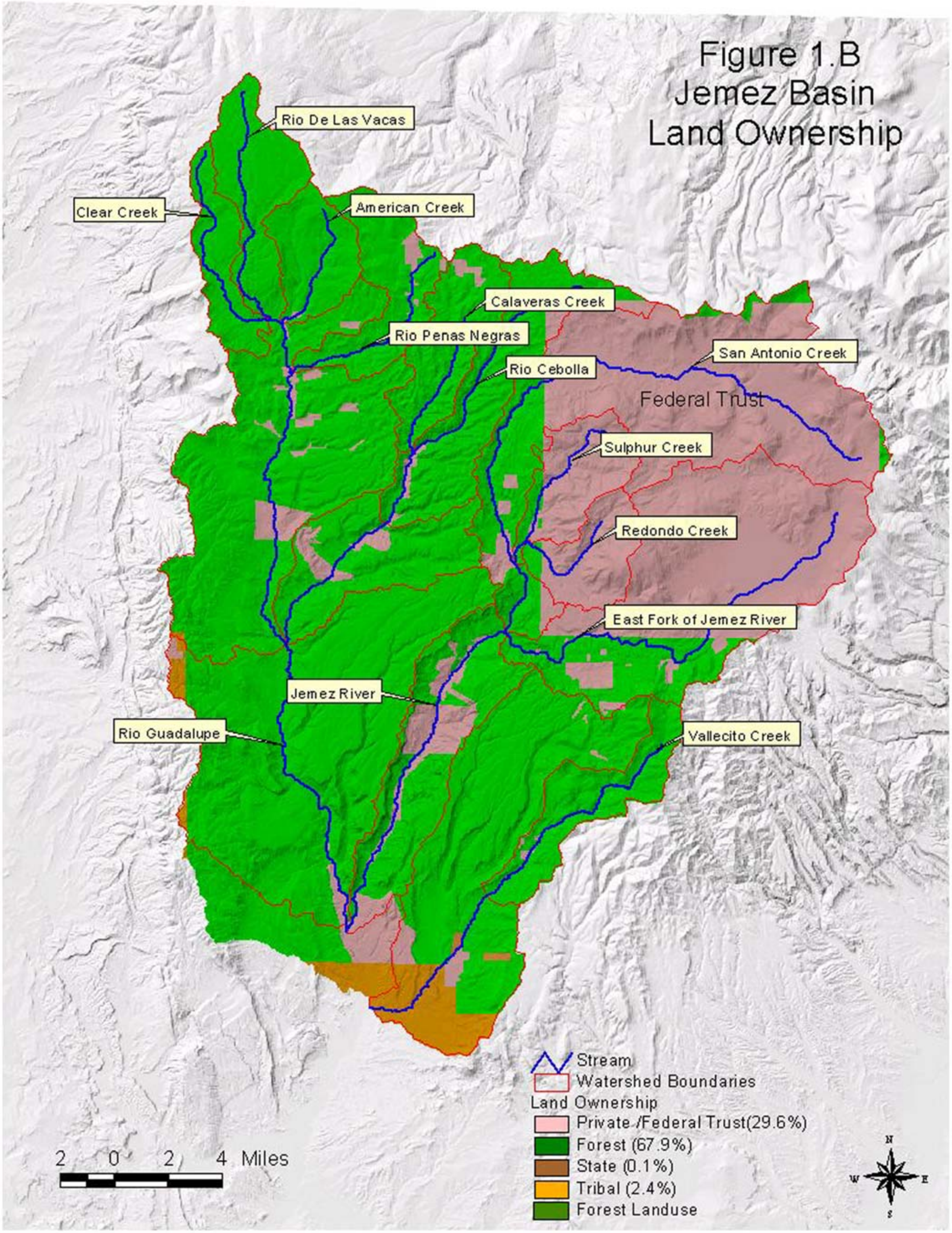
Figure 1.B
Jemez Basin
Land Ownership
Rio De Las Vacas
Clear Creek
American Creek
Calaveras Creek
Rio Penas Negras
San Antonio Creek
Rio Cebolla
Federal Trust
Sulphur Creek
Redondo Creek
East Fork of Jemez River
Jemez River
Rio Guadalupe
Vallecito Creek
Stream
Watershed Boundaries
Land Ownership
Private /Federal Trust(29.6%)
Forest (67.9%)
State (0.1%)
Tribal (2.4%)
Forest Landuse
2 0 2 4 Miles
N
W
E
S

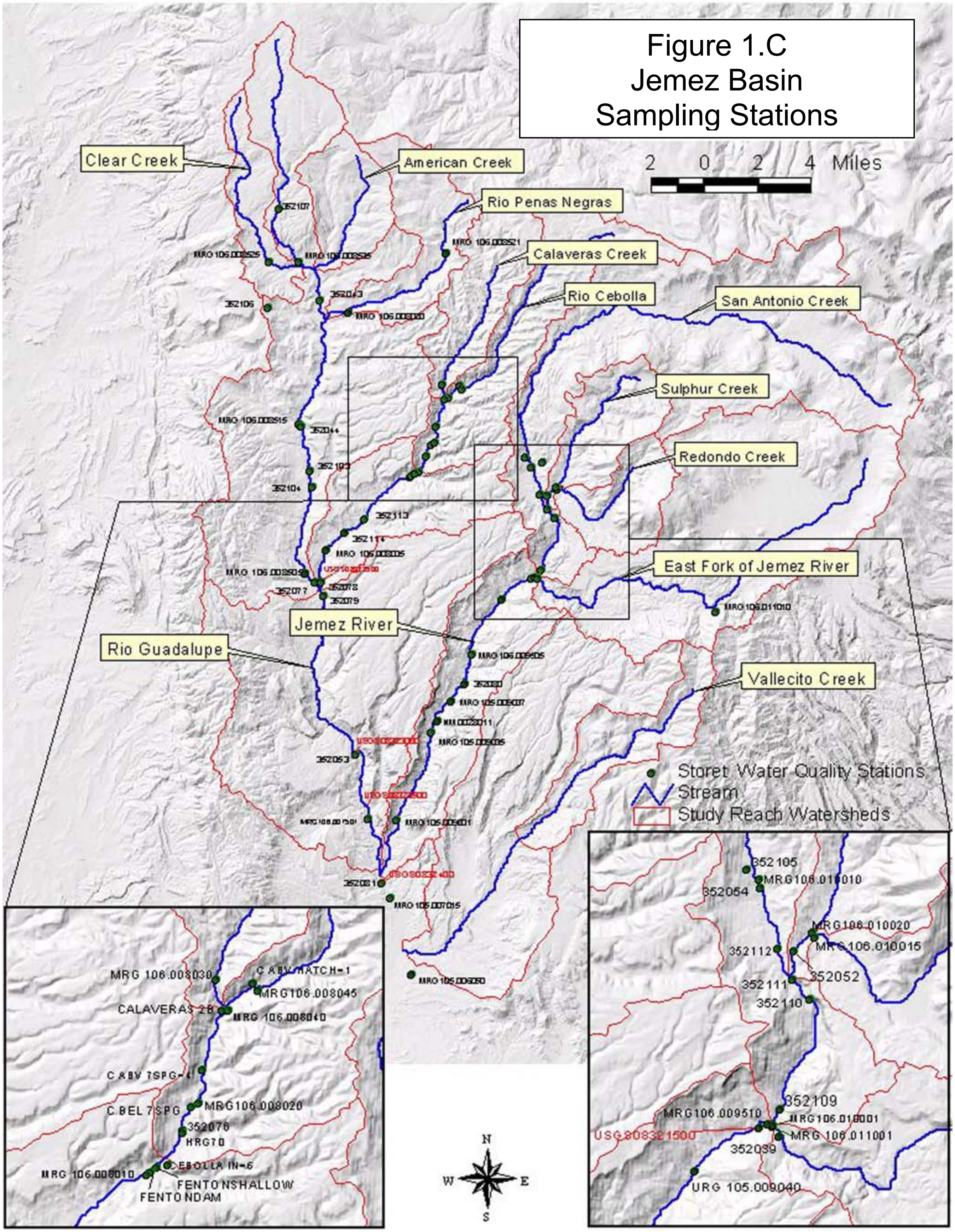
Figure 1.C
Jemez Basin
Sampling Stations
2 0 2 4 Miles
Clear Creek
American Creek
Rio Penas Negras
Calaveras Creek
Rio Cebolla
San Antonio Creek
Sulphur Creek
Redondo Creek
East Fork of Jemez River
Jemez River
Rio Guadalupe
Vallecito Creek
Storet Water Quality Stations
Stream
Study Reach Watersheds
MRG 106.008030
C ABV HATCH-1
MRG106.008045
CALAVERAS 2B
MRG 106.008040
C ABV 7SPG-4
C BEL 7SPG
MRG106.008020
352076
CEBOLLA IN-6
MRG 106.008010
FENTONSHALLOW
FENTONDAM
352105
MRG106.010010
352054
MRG106.010020
MRG106.010015
352112
352052
352111
352110
352109
MRG106.009510
MRG106.010001
MRG 106.011001
352039
URG 105.009040
N
W
E
S

designated uses for this reach are: domestic water supply, fish culture, high quality coldwater fishery, irrigation, livestock watering, wildlife habitat, and secondary contact. The standards are as follows:

1. In any single sample: conductivity shall not exceed 400 umhos, pH shall be within the range of 6.6 to 8.8, temperature shall not exceed 20 C (68F), and turbidity shall not exceed 25 NTU. The use-specific numeric standards set forth in Section 3101 are applicable to the designated uses listed above in Section 2106A.
2. The monthly geometric mean of fecal coliform bacteria shall not exceed 100/100 ml; no single sample shall exceed 200/100 ml (see Section 1103B) (NMWQCC 1995).

The general standard for turbidity reads: Turbidity attributable to other than natural causes shall not reduce light transmission tot he point that desirable aquatic life presently common in New Mexico waters is inhibited or that will cause substantial visible contrast with the natural appearance of the water. Turbidity attributable to natural causes or the reasonable operation of irrigation and flood control facilities is not subject to these standards (NMWQCC 1995).

The general standard for stream bottom deposits reads: The stream shall be free of water contaminants from other than natural causes that will settle and adversely inhibit the growth of normal flora and fauna or significantly alter the physical or chemical properties of the bottom. Siltation resulting from the reasonable operation and maintenance of irrigation and flood control facilities is not subject to these standards (NMWQCC 1995).

Turbidity

The State's standard leading to an assessment of use impairment is the numeric criteria for turbidity of 25 NTU for a High Quality Coldwater Fishery (HQCWF) and for this specific Coldwater Fishery (CWF). Turbidity levels can be inferred from studies that monitor total suspended solids(TSS concentrations. Extrapolation from these studies is possible because of the relationship between concentrations of TSS and turbidity. Activities that generate varying amounts of TSS will proportionally change or affect turbidity (USEPA 1991).

In this watershed both TSS and turbidity were measured. The TSS analytical method (40CFR 136.3 Method number 160.2, and Standard Methods 20th Edition number 2540D) is a commonly used measurement of suspended material in surface water. TSS concentrations are determined by obtaining a water sample, filtering and drying the sample, and then weighing the residual solids. This method was originally developed for use on wastewater samples. It has been widely used to measure suspended materials in stream samples because it is acceptable for regulatory purposes and is an inexpensive laboratory procedure. This analytic method does not discern between solids produced from erosional activities vs. biosolids when instream samples are collected and analyzed. A strong correlation (R^2=0.79) was found between TSS and turbidity for the Jemez River (Appendix A) and also for the Rio Guadalupe (R^2=0.976) (Appendix B).

Stream Bottom Deposits

The Surface Water Quality Bureau (SWQB) has compiled techniques to measure the level of embeddedness of a stream bottom in a SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) in order to address the narrative criteria for stream bottom deposits (SBD). The purpose of the Protocol is to provide a reproducible quantification of the narrative criteria for stream bottom deposits (SBD). The impact of fine sediment deposits is well documented in the literature. USEPA (1991) states that "An increased sediment load is often the most important adverse effect of ....activities on streams." This impact is largely a mechanical action that severely reduces the available habitat for macroinvertebrates and fish species that utilize the streambed in various life stages. An increase in suspended sediment concentration will reduce the penetration of light, decreases the ability of fish on fingerlings to capture prey, and reduce primary production (US EPA 1991). The SWQB Sediment Workgroup evaluated a number of methods described in the literature that would provide information allowing a direct assessment of the impacts to the stream bottom substrate. A final list of monitoring procedures was implemented at a wide variety of sites during the 1998 monitoring season. These procedures included conducting pebble counts (a measurement of % fines), stream bottom cobble embeddedness, Rosgen (1996) geomorphology, and various biological measures.

The target levels involved the examination of developed relationships between embeddedness, fines, and biological score. Using existing data from New Mexico, a strong relationship (R^2=0.7511) was established between embeddedness and the biological scores from the SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) sampling from 1998 (Appendix C). A strong correlation (R^2= 0.719) was also found when relating embeddedness to percent fines (Appendix C). These relationships show that at the desired biological score (at least 70, per the SWQB Assessment Protocol 1998) the target embeddedness (for fully supporting a designated use) would be 45%, and the target fines would be 20%. Since this relationship is based on New Mexico streams it was chosen for the target value for percent fines.

Results from biological sampling at each sampling site are used to support the SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) results. Analysis of the benthic communities at the Jemez River and the Rio Guadalupe near their confluence shows these downstream stations to be only partially supporting its designated use for biological quality (relative to a reference station on the San Antonio Creek near Battleship Rock). Selection of those metrics that are particularly suited to the delineation of sediment impacts highlights the degree of impairment. The EPT (Ephemeroptera, Plecoptera, Tricoptera) Index, the number of sediment adapted organisms, taxa richness, Hilsenhoff's Biotic Index and the Biotic Community Index all indicate some degree of impairment attributable to sedimentation.

Flow

Sediment movement in a stream varies as a function of flow. As flow increases the concentration of sediment increases. This TMDL is calculated for each reach at a specific flow. When available, US Geologic Survey gages are used to estimate flow. In this case the gage for the Jemez River (USGS 08329000) is located 0.8 miles downstream from Jemez Canyon Dam, 2.0 miles upstream from the mouth, and 6 miles north of Bernalillo (USGS 1989). The gage for the Rio Guadalupe (USGS 08323000) is located at the downstream end of Guadalupe Box Canyon, 4.8 miles upstream from the mouth, 5 miles southwest of Jemez Springs, and 7 miles north of Jemez (USGS 1989). Where gages are absent, geomorphological cross sectional information is taken at each site and the flows are modeled. It is important to remember that the TMDL is a planning tool to be used to achieve water quality standards. Since flows vary throughout the year in these systems the target load will vary based on the changing flow. Management of the load should set a goal at water quality standards attainment; not meeting the calculated target load.

*Calculation*s

Target loads for turbidity (expressed as TSS) are calculated based on a flow, the current water quality standards, and a unit less conversion factor, 8.34 that is a used to convert mg/L units to lbs/day (see

Appendix D for Conversion Factor Derivation). The target loading capacity is calculated using Equation 1.

Equation 1. critical flow (mgd) x standard (mg/L) x 8.34 (conversion factor) = target loading capacity

The target loads (TMDLs) predicted to attain standards were calculated using Equation 1 and are shown in Table 1.

Table 1: Calculation of Target Loads

Location	Flow (mgd)	Standards		Conversion Factor	Target Load Capacity
		TSS* (mg/L)	SBD** (% fines)		
Jemez River	151+	16.6	20	8.34	20905 (lbs/day) 20%
Rio Guadalupe	117++	31.2	20	8.34	30444 (lbs/day) 20%

+ Flow is the greatest monthly mean flow at each location collected periodically from 1936-1989 USGS gage 08329000 (USGS 1989).
++ Flow is the greatest monthly mean flow at each location collected periodically from 1938-1989 USGS gage 08323000 (USGS 1989).
*These values are calculated using the relationship established between TSS and turbidity (Jemez y=1.025x-9.039, R^2=0.7948 Appendix A and Guadalupe y=1.0311x+5.399 R^2=.976 Appendix B). The turbidity standard is 25 NTU.
** This value is based on a narrative standard. The background values for stream bottom deposits were taken from the SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (1999a).

The measured loads were calculated using Equation 1. In order to achieve comparability between the target and measured loads, the flows used were the same for both calculations. The geometric mean of the data that exceeded the standards from the data collected at each site was substituted for the standard in Equation 1. The same conversion factor of 8.34 was used. Results are presented in Table 2.

Background loads were not possible to calculate in this watershed. A reference reach, having similar stream channel morphology and flow, was not found. It is assumed that a portion of the load allocation is made up of natural background loads. In future water quality surveys, finding a suitable reference reach will be a priority.

Table 2: Calculation of Measured Loads

Location	Flow (mgd)	Geometric Mean		Conversion Factor	Measured Load Capacity
		TSS* (mg/L)	SBD** (% fines)		
Jemez River	151+	45	20	8.34	56670 (lbs/day) 26%
Rio Guadalupe	117++	69	20	8.34	67329 (lbs/day) 28%

+ Flow is the greatest monthly mean flow at each location collected periodically from 1936-1989 USGS gage 08329000 (USGS 1989).
++ Flow is the greatest monthly mean flow at each location collected periodically from 1938-1989 USGS gage 08323000 (USGS 1989).
*TSS measured during periods when the turbidity standard was exceeded were averaged to calculate these values.
**This value is based on a narrative standard. The background values for stream bottom were taken from the SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (1999a).

<u>Waste Load Allocations and Load Allocations</u>

•*Waste Load Allocation*

The point source contributor for the Jemez River in segment 20.6.4.107 is the Village of Jemez Springs WWTP NPDES No. NM0028011. The waste load allocation and calculation is 28.2 lbs/day (0.075 mgd design flow x 45 mg/L TSS daily maximum x 8.34 conversion factor). The technology-based limit of 45 mg/L was used to calculate the WLA.

•*Load Allocation*

In order to calculate the Load Allocation (LA) the waste load allocation and margin of safety (MOS) were subtracted from the target capacity (TMDL) following Equation 2.

Equation 2. $WLA + LA + MOS = TMDL$

Results are presented in Table 3a (Calculation of TMDLs for Turbidity) and Table 3b (Calculation of TMDLs for Stream Bottom Deposits).

Table 3a: Calculation of TMDL for Turbidity

Location	WLA (lbs/day)	LA (lbs/day)	MOS (25%) (lbs/day)	TMDL (lbs/day)
Jemez River	28.2	15650.8	5226	20905
Rio Guadalupe	0	22833	7611	30444

Table 3b: Calculation of TMDL for Stream Bottom Deposits

Location	WLA (% fines)	LA (% fines)	MOS (25%) (% fines)	TMDL (% fines)
Jemez River	0	15	5	20
Rio Guadalupe	0	15	5	20

The load reductions that would be necessary to meet the target loads were calculated to be the difference between the target load (Table 1) and the measured load (Table 2), and are shown in Table 4 (Calculation of Load Reductions).

Table 4: Calculation of Load Reductions

Location	Target Load		Measured Load		Load Reductions	
	TSS (lbs/day)	SBD (%fines)	TSS (lbs/day)	SBD (%fines)	TSS (lbs/day)	SBD (% fines)
Jemez River	20905	20	56670	26	35765	6
Rio Guadalupe	30444	20	67329	28	36885	8

Identification and Description of pollutant source(s)

Table 5: Pollutant Source Summary

Pollutant Sources	Magnitude (Load Allocation + MOS)	Location	Potential Sources* (% from each)
Point: Turbidity (as TSS in lbs/day)	28.2	Jemez River	Municipal Point Source (Village of Jemez WWTP) 0.16%
	0	Rio Guadalupe	None 0%
Nonpoint: •Sediment			Road Maintenance/Runoff Recreation Streambank Modification/Destabilization Removal of Riparian Vegetation Natural Agriculture
Turbidity (as TSS in lbs/day)	15650.8	Jemez River	99.84%
(as TSS in lbs/day)	30421	Rio Guadalupe	100%
Stream Bottom Deposits (% fines)	20	Jemez River	100%
(% fines)	20	Rio Guadalupe	100%

* Potential sources for both turbidity and stream bottom deposits are from similar sources with the exception of the Village of Jemez Springs Municipal WWTP located on the Jemez River in Segment 20.6.4.107. All other sources apply to both the Jemez River and the Rio Guadalupe.

Linkage of Water Quality and Pollutant Sources

Where available data are incomplete or where the level of uncertainty in the characterization of sources is large, the recommended approach to TMDL assignments requires the development of allocations based on estimates utilizing the best available information.

SWQB fieldwork includes an assessment of the potential sources of impairment (SWQB/NMED 1999b). The Pollutant Source(s) Documentation Protocol, shown as Appendix E, provides an approach for a visual analysis of the source along an impaired reach. Although this procedure is subjective, SWQB feels that it provides the best available information for the identification of potential sources of impairment in this watershed. Table 5 (Pollutant Source Summary) identifies and quantifies potential sources of nonpoint source impairments along each reach as determined by field reconnaissance and assessment. A further explanation of the sources follows.

Pollutant Sources on the Jemez River and Rio Guadalupe

The main source of impairment along these reaches appears to be road maintenance and runoff. This includes the flushing of arroyos after precipitation events that cross the road along the river and are then channelized directly into the streams. Recreation areas have been established to provide fishing access to the rivers on Forest Service land. These recreational sites provide direct sediment input from the parking areas and have led to the removal of riparian vegetation and some streambank destabilization. Agricultural practices do occur along these reaches, mostly in the form of grazing and appear to have contributed to the removal of riparian vegetation and streambank destabilization. Since the soil is highly erosive, some natural inputs do occur along the reach. Although reaches upstream from the Jemez River and the Rio Guadalupe are not impaired, they may still contribute some sediment to downstream reaches. Therefore, it is important to consider not only the land directly adjacent to the river (which is managed by the Forest Service or held privately) but also to consider upland and upstream areas in a more holistic watershed approach to implementing this TMDL.

The Village of Jemez WWTP does have the potential to increase TSS loads in the Jemez River, although there is some debate as to the level at which TSS discharged from WWTP directly contributes to turbidity impairment. The TSS contribution from the WWTP is minimal compared to the non-point source contribution (0.16% and 99.84%, respectively).

Margin of Safety (MOS)

TMDLs should reflect a margin of safety based on the uncertainty or variability in the data, the nonpoint source load estimates, and the modeling analysis. The explict MOS for this TMDL is 25% from the Load Allocation. The MOS is the sum of two elements:

- *Errors in calculating NPS loads*

  A level of uncertainty does exist in the relationship between TSS and turbidity. In this case, the TSS measure does not include bedload and therefore does not account for a complete measure of sediment load. This does not influence the MOS because we need only be concerned with the turbidity portion of the sediment load, which is the basis for the standard. However, there is a potential to have errors in measurements of nonpoint source loads due to equipment accuracy, time of sampling, etc. A conservative position is to reduce the NPS load by 25% and assign it to the MOS.

- *Errors in calculating flow*

  Flow estimates were based on USGS gages. Conservative values were used to calculate loads and do not warrant additional MOS.

The MOS for point sources is implicit because permitted flows are used to calculate the waste loads.

Consideration of seasonal variation

Data used in the calculation of this TMDL were collected during spring, summer, and fall in order to ensure coverage of any potential seasonal variation in the system. Since the critical condition is set to high flows, spring data were used in the calculation of the sediment relationships used in determining the target capacities.

Monitoring Plan

Pursuant to Section 106(e)(1) of the Federal Clean Water Act, the SWQB has established appropriate monitoring methods, systems and procedures in order to compile and analyze data on the quality of the surface waters of New Mexico. In accordance with the New Mexico Water Quality Act, the SWQB has developed and implemented a comprehensive water quality monitoring strategy for the surface waters of the State. The monitoring strategy establishes the methods of identifying and prioritizing water quality data needs, specifies procedures for acquiring and managing water quality data, and describes how these data are used to progress toward three basic monitoring objectives: to develop water quality-based pollution controls, to evaluate the effectiveness of such controls and to conduct water quality assessments.

The SWQB utilizes a rotating basin system approach to water quality monitoring. In this system, a select number of watersheds are intensively monitored each year with an established return frequency of every five years.

The SWQB maintains current quality assurance and quality control plans to cover all monitoring activities. This document "Quality Assurance Project Plan for Water Quality Management Programs" (QAPP) is updated annually.

Current priorities for monitoring in the SWQB are driven by the 303(d) list of streams requiring TMDLs. Short-term efforts are directed toward those waters which are on the EPA TMDL consent decree (Forest Guardians and Southwest Environmental Center v. Carol Browner, Administrator, US EPA, Civil Action 96-0826 LH/LFG, 1997) list and which are due within the first two years of the monitoring schedule. Once assessment monitoring is completed those reaches still showing impacts and therefore requiring a TMDL will be targeted for more intensive monitoring. The methods of data acquisition include fixed-station monitoring, intensive surveys of priority water bodies, including biological assessments, and compliance monitoring of industrial, federal and municipal dischargers, and are specified in the Assessment Protocol (SWQB/NMED 1998).

Pebble counts are used to develop a particle size distribution curve of the bed surface material. The method described by Wolman (1954) was selected for inclusion in the parameter suite evaluated during the sample season. The advantage of this procedure is that it is relatively quick to perform and is reproducible. In streams dominated by fine sediments, coarser particles that provide beneficial habitat tend to become surrounded or buried in fines leading to a loss of suitable habitat. Cobble embeddedness is a measure of the extent to which these coarser particles are buried by these finer sediments and has both biological and physical significance (USEPA 1991). The sampling procedure chosen for New Mexico streams is that devised by Skille and King (1989). This technique uses 60-cm diameter hoops as the basic sampling unit. The use of hoops rather than individual particles as the basic unit of measure reduces the variability of the sample. Software obtained from the Idaho Bureau of Reclamation allows for the evaluation of the data (Burton 1990). Values calculated and reported by the software are percent embeddedness, the Interstitial Space Index (ISI), and percent free matrix cobble. Also available in the software is a sample size evaluator that helps in determinations of whether sufficient sample size has been collected to statistically define the population. The advantage of this procedure is that it is quantifiable. The major disadvantage is in the substantial effort required to complete the data collection.

Long term monitoring for assessments will be accomplished through the establishment of sampling sites that are representative of the waterbody and which can be revisited every five years. This gives an unbiased assessment of the waterbody and establishes a long term monitoring record for simple trend analyses. This information will provide time relevant information for use in 305(b) assessments and to support the need for developing TMDLs.

This approach provides:

- a systematic, detailed review of water quality data and allows for efficient use of monitoring resources.
- information at a scale where implementation of corrective activities is feasible.
- an established order of rotation and predictable sampling in each basin, which allows for enhanced coordinated efforts with other programs.
- program efficiency and improves the basis for management decisions.

It should be noted that a basin will not be ignored during its four year sampling hiatus. The rotating basin program will be supplemented with other data collection efforts which will be classified as field studies. This time will be used to analyze the data collected, conduct field studies to further characterize identified problems, and develop and implement TMDLs. Both types of monitoring, long term and field studies, can contribute to the §305(b) and §303(d) listing processes. There will be a TSS limitation and monitoring requirement in the approved NPDES permit along with a re-opener clause, which will be utilized if changes to the TMDL or WQS will result in changes to the conditions of the permit. Any elevated levels of TSS beyond the permitted limits are considered a violation of the permit, and are subject to enforcement action.

The following schedule is for sampling seasons through 2002 and will be done in a consistent manner to support the New Mexico Unified Watershed Assessment (UWA) and the Nonpoint Source Management Program. This sampling regime allows characterization of seasonal variation through sampling in spring, summer, and fall for each of the watersheds.

1998 - Jemez, Chama (above El Vado), Cimarron (above Springer), Santa Fe, San Francisco
1999 - Chama (below El Vado), middle Rio Grande, Gila, Red River
2000 - Dry Cimarron, upper Rio Grande (part1)
2001 - Upper Rio Grande (part 2), upper Pecos (headwaters to Ft. Sumner), Valles Caldera
2002 - Canadian Basin (part 1), San Juan, Mimbres

Implementation plan

Management Measures

Management measures are "economically achievable measures for the control of the addition of pollutants from existing and new categories and classes of nonpoint sources of pollution, which reflect the greatest degree of pollutant reduction achievable through the application of the best available nonpoint source pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives" (USEPA, 1993). A combination of best management practices (BMPs) will be used to implement this TMDL. For this watershed the focus will be on sediment control. BMPs in this area will include proper road maintenance practices and drainage controls, improved grazing management practices, relocation of established recreation sites away from riparian areas, the development of defined roads, parking, and camping areas to discourage uncontrolled dispersed camping and the creation of new roads, riparian plantings, and hydrogeomorphic river restoration. The SWQB will work with the New Mexico State Highway and Transportation Department (NMSHD), the USDA Forest Service (FS), Jemez Pueblo, and private landowners in implementing these BMPs throughout the watershed.

Presently, the FS is addressing several sources of NPS pollution that originate on properties managed by the FS in this watershed. Such activities and proposals include: timber thinning and prescribed fire to prevent catastrophic wildfires and to improve groundcover and watershed conditions, improved grazing management, road closures, relocation of roads out of riparian areas, improvements to existing recreation sites to protect riparian areas, and fencing of riparian areas to exclude livestock and vehicles. The SWQB will continue coordination with the FS in implementing BMPs in this watershed.

Stakeholder and public outreach and involvement in the implementation of this TMDL will be ongoing. Stakeholder participation will include choosing and installing BMPs, as well as potential volunteer monitoring. Stakeholders in this process will include: SWQB, FS, NMSHD, local government, private landowners, tribes, environmental groups, and the general public.

Time Line

Implementation Actions	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Public Outreach and Involvement	X	X	X	X	X
Establish Milestones	X				
Secure Funding	X		X		
Implement Management Measures (BMPs)		X	X		
Monitor BMPs		X	X	X	
Determine BMP Effectiveness				X	X
Re-evaluate Milestones				X	X

Assurances

New Mexico's Water Quality Act does not contain enforceable prohibitions directly applicable to nonpoint sources of pollution. The Act does authorize the Water Quality Control Commission to "promulgate and publish regulations to prevent or abate water pollution in the state" and to require permits. New Mexico policies are in accordance with the federal Clean Water Act §101(g):

> *It is the policy of Congress that the authority of each State to allocate quantities of water within its jurisdiction shall not be superseded, abrogated or otherwise impaired by this Act. It is the further policy of Congress that nothing in this Act shall be construed to supersede or abrogate rights to quantities of water which have been established by any State. Federal agencies shall co-operate with State and local agencies to develop comprehensive solutions to prevent, reduce and eliminate pollution in concert with programs for managing water resources.*

Nonpoint source water quality improvement work utilizes a voluntary approach. This provides technical support and grant money for the implementation of best management practices and other NPS prevention mechanisms through §319 of the Clean Water Act. Since this TMDL will be implemented through NPS control mechanisms the New Mexico Nonpoint Source Program is targeting efforts to this watershed. The Nonpoint Source Program coordinates with the Nonpoint Source Taskforce. The Nonpoint Source Taskforce is the New Mexico statewide focus group representing federal and state agencies, local governments, tribes and pueblos, soil and water conservation districts, environmental organizations, industry, and the public. This group meets on a quarterly basis to provide input on the Section 319 program process, to disseminate information to other stakeholders and the public regarding nonpoint source issues, to identify complimentary programs and sources of funding, and to help review and rank Section 319 proposals.

In order to ensure reasonable assurances for implementation in watersheds with multiple landowners, including Federal, State and private land, NMED has established MOUs with several Federal agencies, in particular the Forest Service and the Bureau of Land Management. MOUs have also been developed with other State agencies, such as the New Mexico Highway Department. These MOUs provide for coordination and consistency in dealing with nonpoint source issues.

New Mexico's Clean Water Action Plan has been developed in a coordinated manner with the State's 303(d) process. All Category I watersheds identified in New Mexico's Unified Watershed Assessment process are totally coincident with the impaired waters list for 1996 and 1998 approved by EPA. The State has given a high priority for funding assessment and restoration activities in these watersheds.

The time required to attain standards for all reaches in this watershed is estimated to be approximately 10-20 years. This estimate is based on a five-year time frame for implementation. Watershed projects will be started incrementally; a few projects are already established in response to earlier projects. The cooperation of private landowners and Federal Agencies will be pivotal in the implementation of this TMDL.

Milestones

Milestones will be used to determine if control actions are being implemented and standards attained. For this TMDL several milestones will be established that will vary based on the BMPs implemented at each site. Examples of milestones include a percentage reduction in stream bottom deposits within a certain time frame, update or develop MOUs with other state and federal agencies by 2001 to ensure protection and restoration in this watershed, and to increase education and outreach activities regarding sediment erosion in this watershed, particularly for private landowners.

Milestones will be reevaluated periodically, depending on what BMP was implemented. Further implementation of this TMDL will be revised based on this reevaluation. The process will involve monitoring pollutant loading, tracking implementation and effectiveness of controls, assessing water quality trends in the waterbody, and reevaluating the TMDL for attainment of water quality standards.

Public Participation

Public participation was solicited in development of this TMDL. See Appendix F for flow chart of the public participation process. The original draft TMDL was made available for a 30-day comment period starting August, 10, 1999. The revised draft TMDL was made available for a 30-day public comment starting April 13, 2004. Response to comments is attached as Appendix G of this document. The draft document notice of availability was extensively advertised via newsletters, email distribution lists, webpage postings (http://www.nmenv.state.nm.us), and press releases to area newspapers.

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Appendices

Appendix A: Relationship between Turbidity and Total Suspended Sediment on the Jemez River

Appendix B: Relationship between Turbidity and Total Suspended Sediment on the Rio Guadalupe

Appendix C: SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) Relationships

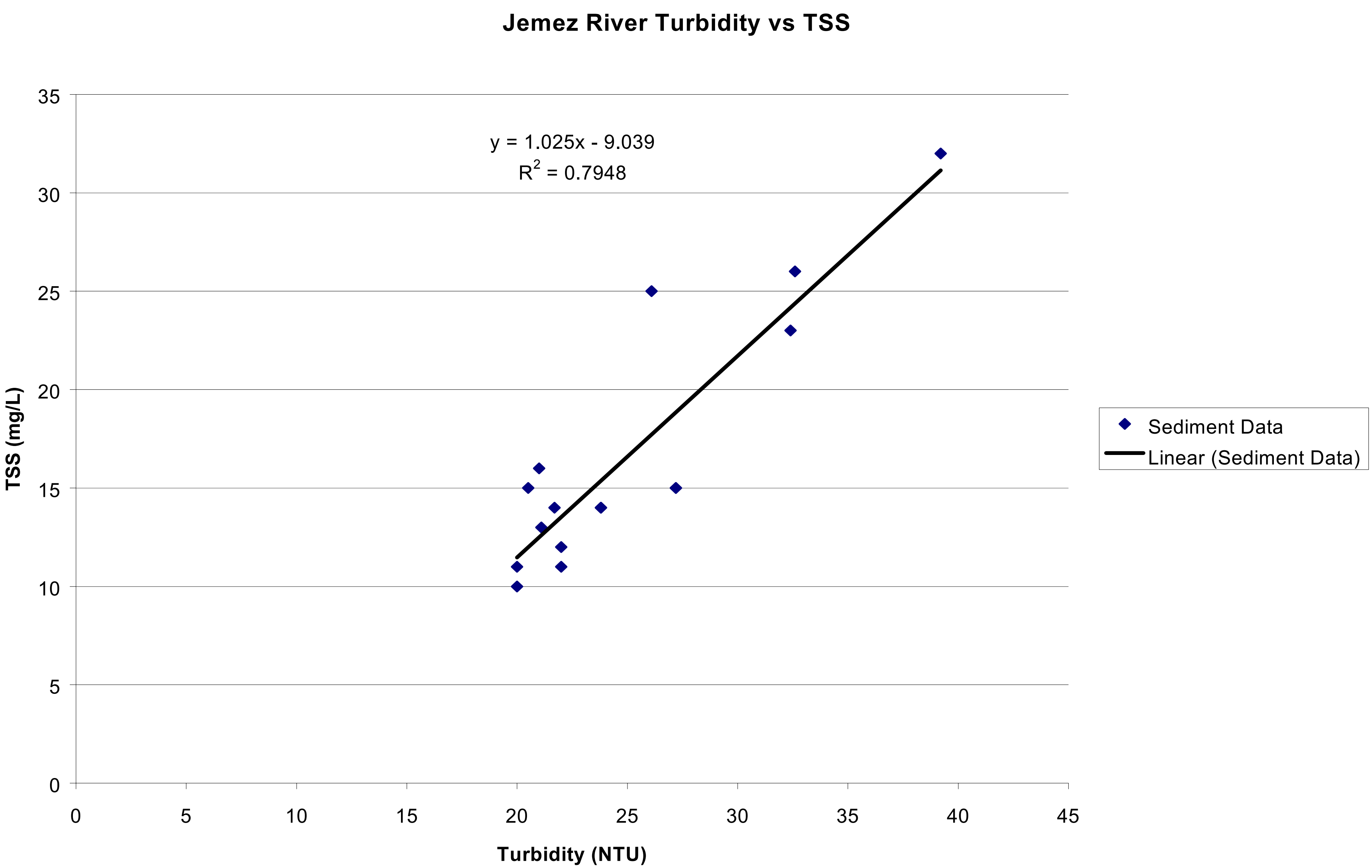
Appendix D:Conversion Factor Derivation

Appendix E Pollutant Source(s) Documentation Protocol

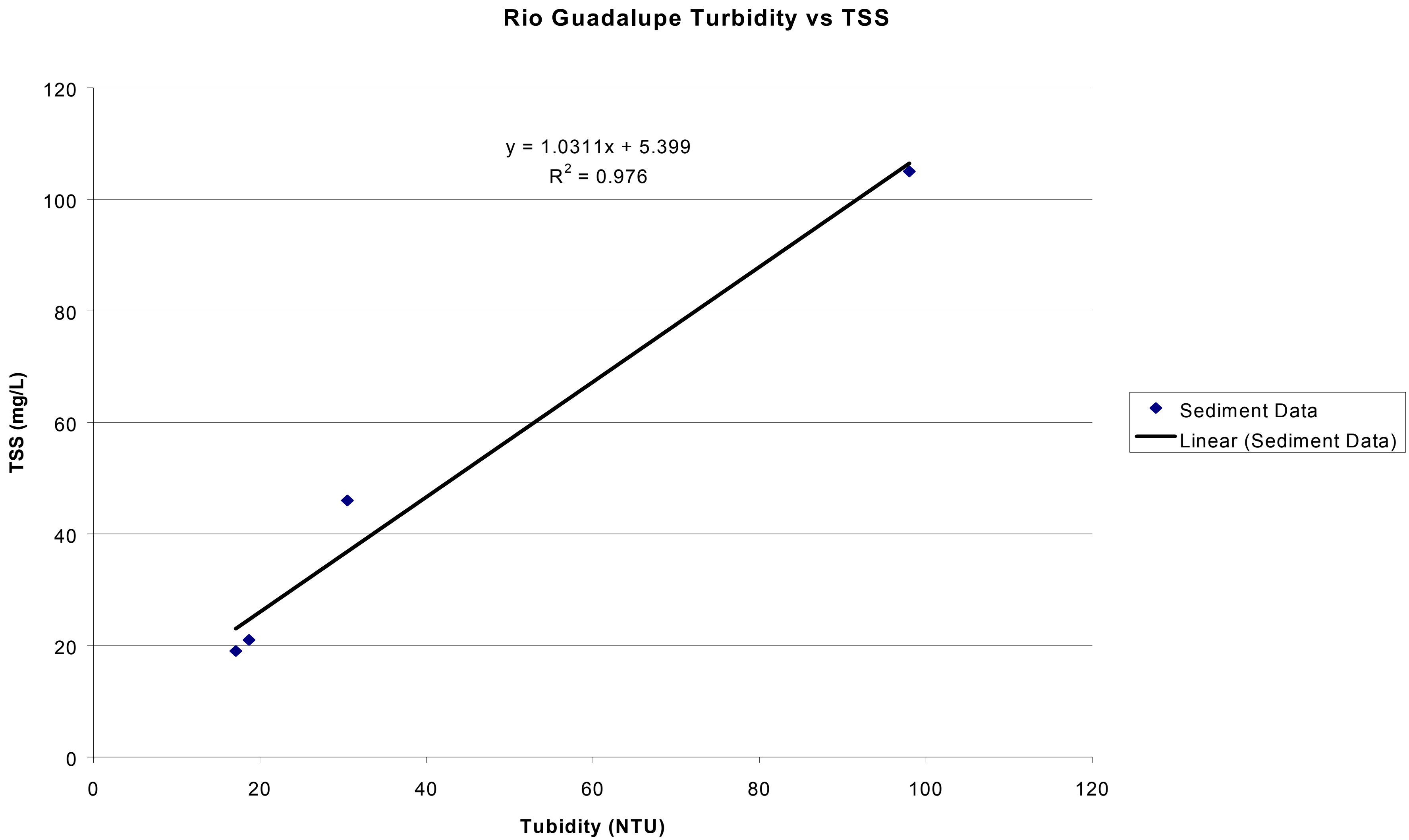
Appendix F: Public Participation Process Flowchart

Appendix G: Response to Comments

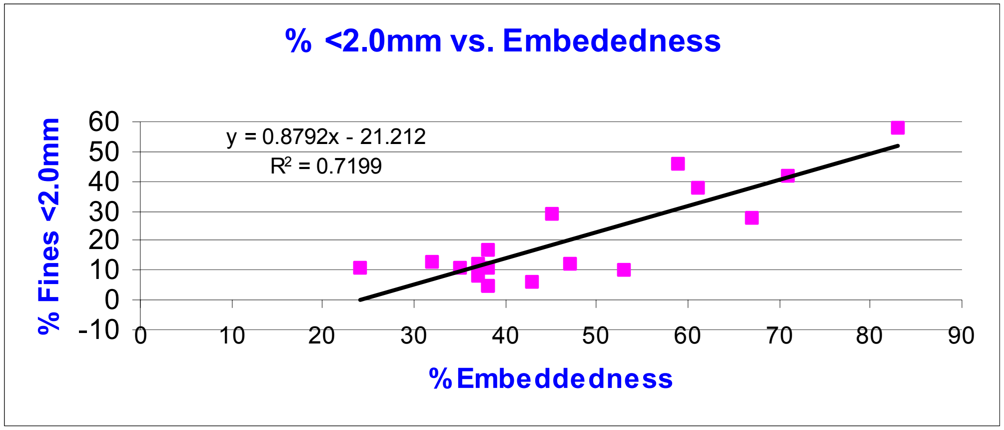
Appendix A: Relationship between Turbidity and TSSon the Jemez River

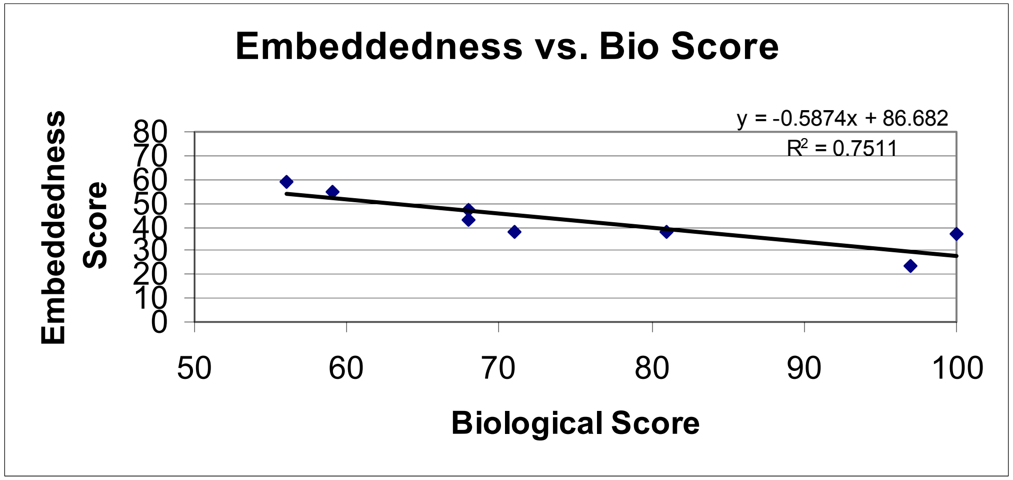


Appendix B: Relationship between Turbidity and TSS on the Rio Guadalupe



Appendix C SWQB/NMED draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) Relationships





Appendix D: Conversion Factor Derivation

Flow (as million gallons per day [MGD]) and concentration values (milligrams per liter [mg/L]) must be multiplied by a conversion factor in order to express the load in units "pounds per day." The following expressions detail how the conversion factor was determined:

TMDL Calculation:

$$Flow\left(MGD\right)\times Concentration\left(\frac{mg}{L}\right)\times CF\left(\frac{L-lb}{gal-mg}\right)=Load\left(\frac{lb}{day}\right)$$

Conversion Factor Derivation:

$$CF = 10^{6}\times\frac{3.785\,L}{gal}\times\frac{1\,lb}{454{,}000\,mg}=8.34\,\frac{L-lb}{gal-mg}$$

Appendix E

POLLUTANT SOURCE(S) DOCUMENTATION PROTOCOL

This protocol was designed to support federal regulations and guidance requiring states to document and include probable source(s) of pollutant(s) in their §303(d) Lists as well as the States §305(b) Report to Congress.

The following procedure should be used when sampling crews are in the field conducting water quality surveys or at any other time field staff are collecting data.

Pollutant Source Documentation Steps:

1). Obtain a copy of the most current §303(d) List.

2). Obtain copies of the ***Field Sheet for Assessing Designated Uses and Nonpoint Sources of Pollution***.

3). Obtain 35mm camera that has time/date photo stamp on it. **DO NOT USE A DIGITAL CAMERA FOR THIS PHOTODOCUMENTATION**

4). Identify the reach(s) and probable source(s) of pollutant in the §303(d) List associated with the project that you will be working on.

5). Verify if current source(s) listed in the §303(d) List are accurate.

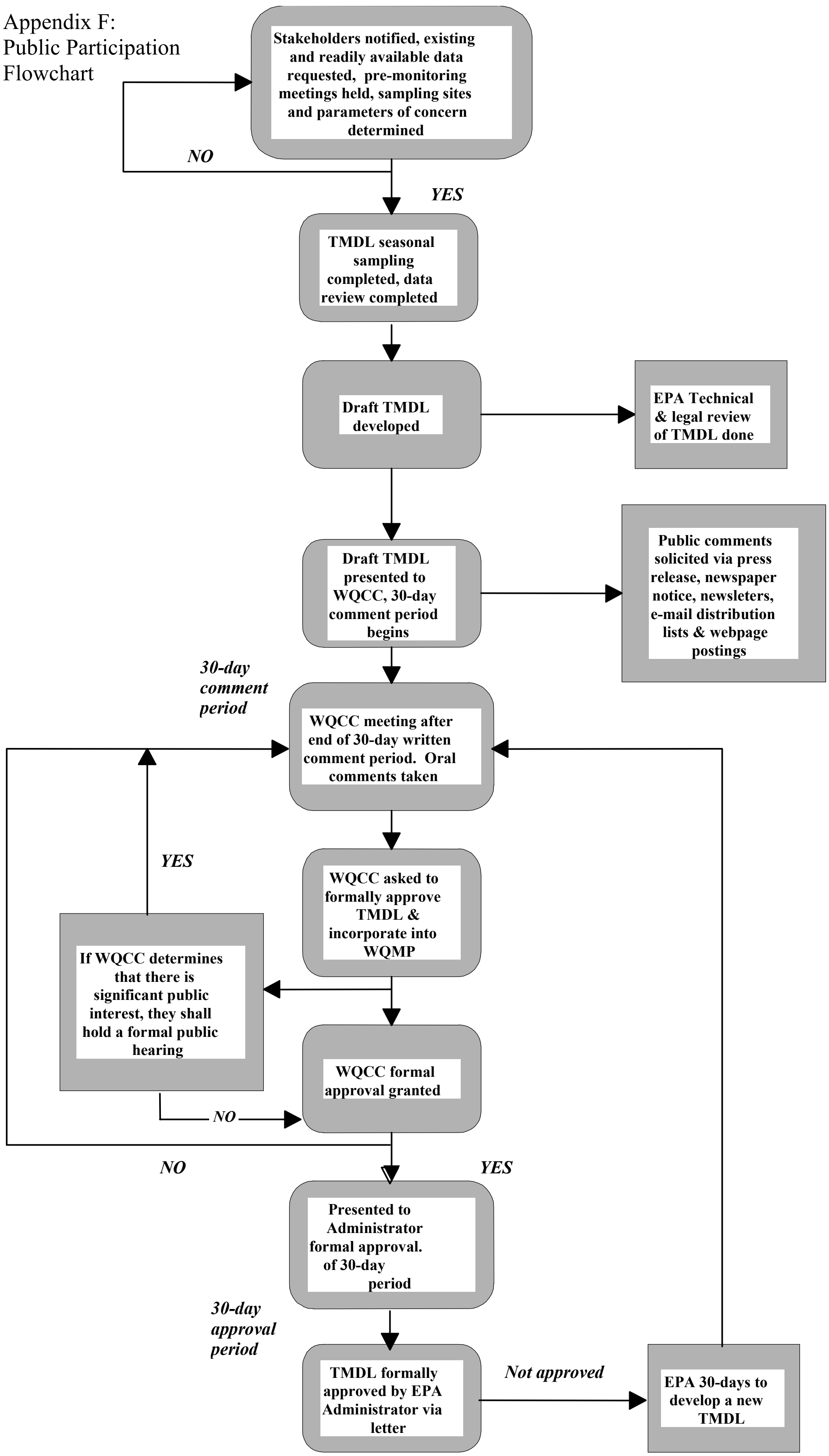
6). Check the appropriate box(s) on the field sheet for source(s) of nonsupport and estimate percent contribution of each source.

7). Photodocument probable source(s) of pollutant.

8). Create a folder for the TMDL files, insert field sheet and photodocumentation into the file.

This information will be used to update §303(d) Lists and the States §305(b) Report to Congress

Appendix F:
Public Participation
Flowchart



Appendix G

COMMENTS and RESPONSES TO ORIGINAL DOCUMENT:

Leonard Atencio, Forest Supervisor, Santa Fe National Forest, Santa Fe, NM
Received 9/09/99

C: Cover Page: The Ecoregion of "Southern Rockies" needs to be referenced.

R: The ecoregion "Southern Rockies" has been referenced.

C: Figures 1 page 2: How is the upper end of the TMDL reach identified if there is no sampling station above the one on the lower end? Without a sampling station at the top end, how does one know where the impaired reach begins?

R: The upper end of the TMDL reach on the Rio Guadalupe was defined based on the change in the geology along the reach. Similar to the Jemez River, the Rio Guadalupe transitions from a hard rock to a sandstone geology. It is at this transition that the impairments were noticed on the Jemez River. The existing listing on the 303(d) list for the Rio Guadalupe is from the mouth on the Jemez River to the confluence of the Rio de las Vacas and Rio Cebolla. SWQB assessment of the reach indicates that the impairment for which this TMDL has been developed is from the Gillman Tunnels to the confluence with the Jemez River.

C: Figure 2 on page 3: The northern tip of the Jemez Watershed, including the headwaters of the Rio de las Vacas, is on Forest Service land (San Pedro Parks Wilderness), not private, as the shading indicates.

R: The map coverage was not developed by NMED/SWQB, it was downloaded from BLM Digital Coverage (1:250,000 and 1:100,000, 1997). The Bureau does not have the ability in-house to change the land ownership on the map coverage.

C: Page 5, top two paragraphs: It appears that a stream geomorphological classification system is being used in a regulatory manner for defining fine sediments in a stream reach. This method does not take into consideration soils, the basic geology of the area, or stream channels in transition within their setting which could be confused with destabilized banks. There are a variety of other assessment methodologies available. One such methodology rigorously examines each reach and characterizes that reach for its unique capability and current site-specific impacts.

R: Stream geomorhphological classification system was not meant to be used in a "regulatory manner" in this TMDL. SWQB's draft Protocol for the Assessment of Stream Bottom Deposits (SWQB/NMED 1999a) was used for the development of the target value for percent fines. In order to clarify this in the document, the specific language relating to the stream geomorphological classification on these reaches was removed.

C: Page 9: The reference to recreation sites needs to be more specific. The sites on public lands on the lower Jemez are hardened and major sediment loads originating from the are not likely. The dispersed sites on the Rio Guadalupe and tributaries do present sediment sources and as is stated later in the document, will be addressed.

R: The recreation sites along the Jemez may not provide sediment loads originating from the site but provide a conduit for the transport of sediment particularly over the roads and parking surfaces. Without vegetation these areas act as "hardened" surfaces through which sediment-laden water may enter the river.

C: Page 11: Cobble embeddedness needs to be clarified. Some stream reaches might not have the capability for cobble and may instead provide gravel of a combination of coarse fragments.

R: Cobble embeddedness and other techniques used in understanding sediment loads in streams are described generally in the Monitoring Plan section of this TMDL. For more information on cobble embeddedness and other monitoring techniques please refer to the citations throughout the document.

Steven Rae, Group Leader, Water Quality and Hydrology Group, Los Alamos National Laboratory, Los Alamos, NM
Received 9/09/99

C: The method for assigning the Margin of Safety in all three of the TMDL s appears to be based on estimates of the data quality. As the monitoring data is collected and confidence in the data is increased, will the Margin of Safety be adjusted? Adjustment of the Margin of Safety could be an important aspect in stream segments where the TMDL has a direct effect on point sources.

R: SWQB agrees that margin of safety plays a role in the quantification of a TMDL. SWQB is preparing a protocol that will explain the quantification of margin of safety in TMDL documents. The margin of safety is adjusted in the TMDL documents as data collection and confidence increases.

COMMENTS and RESPONSES TO REVISION OF DOCUMENT:

No comments were received.